

THE FORMS OF THE COMMON OLD WORLD SWALLOW-TAIL BUTTERFLY (*PAPILIO MACHAON*) IN NORTH AMERICA, WITH DESCRIPTIONS OF TWO NEW SUBSPECIES

By AUSTIN H. CLARK

Curator, Division of Echinoderms, United States National Museum

The common Old World swallowtail, *Papilio machaon*, is found in North America from western Alaska south of Cape Prince of Wales to Yukon and southward to the extreme northwestern portion of British Columbia, and also from the southeastern extremity of James Bay to the Nelson River on the western shore of Hudson Bay and southward to Lake Superior.

Although it is locally common in many places in both the western and eastern portion of its range, its habitat is so remote and inaccessible that it is a rare insect in collections. Indeed, only seven specimens are known from eastern North America.

In the present paper the status of the American forms of this species is reviewed, and three subspecies are recognized: *Papilio machaon aliaska* Scudder, which is found throughout the western portion of the range; *P. m. hudsonianus*, new subspecies, occurring in the eastern portion of the range; and *P. m. petersii*, new subspecies, from central Alaska, where it occurs with *P. m. aliaska*, of which possibly it is an extreme form.

Papilio machaon was first discovered in North America by Constantin Drexler during an exploration that he made in 1860 in the region of James Bay under the direction of the Smithsonian Institution. Thanks to the facilities afforded him by the Hudson's Bay Co., he was enabled to collect a large quantity of valuable material, which was sent from Moose Factory to London by the company at their expense and later brought to New York free of charge by the Cunard Steamship Co.

At that time the Smithsonian Institution did not maintain a collection of insects, and the four specimens of *Papilio machaon* that he collected were sent to William Henry Edwards. Edwards received from Drexler many other butterflies, among them one of the specimens upon which the description of *Hesperia wyandot* was based, and one of those from which *Pamphila verna* was described, both from Washington, D. C.

From 1865 to 1868 Lieut. William Healy Dall was engaged in work in Alaska under the auspices of the Smithsonian Institution. He made extensive zoological collections, including large numbers of insects. Among the insects were numerous examples of *Papilio machaon*, which on their arrival in Washington were sent to Samuel Hubbard Scudder at Cambridge, Mass.

In 1863, J. William Weidemeyer in listing *Papilio zolicaon* gave as the habitat "Labrador; United States." It is probable that the mention of Labrador was based upon the specimens collected by Drexler and subsequently sent to Edwards, though there is no proof of this. At that time Edwards had not described *oregonia*, and as *zelicaon* Lucas (= *zolicaon* Boisduval) was the only yellow representative of the *Machaon* group known from North America, any yellow form in that group would have been referred to it.

The first definite record of *Papilio machaon* in America was published by Edwards, who wrote in 1868 that some years before he had received several specimens that had been taken by Drexler at Rupert House, Hudson Bay.

Scudder, in 1869, described *Papilio aliaska*, which was based upon 16 specimens collected by Lieutenant Dall, most of them at Nulato (or Nualto), May 20-24, but others on June 5, 6, and 14 at a short distance below the Ramparts (on the Yukon River in central Alaska) and also just above them. Scudder said that Edwards had sent him a specimen from the east coast of Hudson Bay. This was one of the specimens collected by Drexler.

Scudder wrote that his new *Papilio aliaska* was of the same size and facies as *P. zolicaon*. This makes it clear that his description was based upon one or all of the specimens collected by Lieutenant Dall, as the Alaskan form of *P. machaon* is very dark and is in general much like *P. zelicaon*.

In 1882, Edwards said that the specimens from Rupert House had been collected in 1860 by C. Drexler when traveling under the auspices of the Smithsonian Institution. They were picked off the gooseberry bushes early in the morning while stiffened with cold. The species was abundant there. He noted that Lieutenant Dall took his examples at Nulato, and that Lucien M. Turner and E. W. Nelson had found the species common at St. Michael. He remarked that there was great uniformity between all the American specimens he had—four from Hudson Bay and eight from Alaska.

Having assembled a series of the various forms of *Papilio machaon*, he had found that the American form is more melanic than the Old World forms with the exception of that from the Himalayas, and he said that if Ménétriés had not limited his *asiaticus* to the examples that have a straight edge to the inner side of the marginal border of the hind wings his name probably should cover the Ameri-

can form. The American examples, he said, come nearest—and indeed are very near—to the variety from the Himalayas.

In 1883, Edwards said that the Himalayan and the American forms should be united under one name, unless, when more is known of the latter, greater differences appear than we now discover.

In "The Butterfly Book," published in 1898, Dr. W. J. Holland, under *Papilio aliaska*, wrote that "thus far this insect has been received only from Alaska." Under the name of *Papilio machaon* var. *aliaska* he figured, without comment, a specimen that did not come from Alaska at all, but was the one collected by Drexler at Rupert House that Scudder in 1869 said had been sent him by Edwards. He later returned it to Edwards, and it came into the possession of Doctor Holland through his acquisition of the Edwards collection.

In 1905, M. Roger Verity placed *P. m. kamtschadalus* Alphéraky in the synonymy of *P. aliaska* Scudder, and said that *aliaska* is found in the peninsula of Kamchatka and in Alaska. He gave a colored figure of a specimen from Kamchatka identified as *aliaska*, which, except for the narrower black border of the hind wings, very closely resembles Holland's figure of *Papilio machaon* var. *aliaska*. Verity cited Holland's figure, which he evidently considered as representing true *aliaska* Scudder.

In 1906, Wright, in his "Butterflies of the West Coast," recorded *Papilio zolicaon* from Port Wrangel, Alaska, on the southern side of the base of the Alaska peninsula. This is far beyond the range of that species, and the record must have been based upon a specimen of *P. m. aliaska*.

In their revision of the American swallowtails published in 1906, Lord Rothschild and Dr. Karl Jordan gave a synonymy of *Papilio machaon aliaska*, which included notices of individuals from the Hudson Bay region as well as from Alaska and Yukon. The range of the subspecies as given by them—Alaska; Oregon; Hudson Bay—in the west broadly overlaps the ranges of *P. zolicaon* and of the yellow form (*oregonia*) of *P. bairdi*. The inclusion of Oregon was based upon the mention by W. H. Edwards in 1882 of a specimen of *aliaska* from The Dalles on the Columbia River in Wasco County, Oreg., which was probably in reality *zelicaon*, though possibly *P. bairdi* form *oregonia*. Whatever it was it was certainly not *aliaska*. In their synonymy they designated as false the statement made by Edwards that *Papilio machaon aliaska* is the Himalayan form of the species, and they do not question the correctness of the identification of the figure published by Doctor Holland. In the key to the American species of the *Machaon* group, *aliaska* was paired with *Papilio bairdi* form *oregonia*, from which it was differentiated by the absence of a black pupil from the anal ocellus. In the text it was compared only with the very different *P. m. kamtschadalus*, evidently on

the basis of Holland's figure, as is shown by the mention of a black admarginal spot at the distal side of the anal ocellus. Such a spot is conspicuous in specimens from the Hudson Bay region (pl. 3, figs. 1, 2), but there is very seldom any trace of such a spot in Alaskan examples (pl. 2, figs. 1, 2). They listed one bad male in the Tring Museum, but did not give any locality for it.

They gave the range of *Papilio zelicaon* as extending from Alaska, British Columbia, and Alberta southward to Arizona and Colorado. Alaska was included on the strength of Wright's record, which was undoubtedly based upon a specimen of *aliaska*.

In 1907, Verity under the name of *joannisi* described an arctic form of *P. machaon* from Alaska, which is the true *aliaska* of Scudder, as is clearly shown by his photograph. Although Verity made the error of assuming that Holland's figure represents Scudder's *aliaska* and was thereby led to rename the true *aliaska*, he deserves the credit for being the first to point out the fact that *Papilio machaon* occurs in North America in two distinct forms.

In his account of swallowtails of the *Machaon* group occurring in America, published toward the end of 1907 in Seitz's "Macrolepidoptera of the World," Dr. Karl Jordan said that *Papilio machaon* is represented in America by the subspecies *aliaska* Scudder (= *joannisi* Verity) in which the black band on the hind wing is broader than it is in the geographically nearest subspecies *kamtschadalus*. He said that *aliaska* is rather common in July and August at the mouth of the Yukon and other rivers, as well as in the neighborhood of lakes—probably everywhere in the lowlands where Umbelliferae grow. He added that eastward *aliaska* occurs as far as Hudson Bay. The figure he gave represents a typical example of the Hudson Bay form and appears to have been taken from Holland. Doctor Jordan said that *kamtschadalus* Alphéraky is not identical with *aliaska* Scudder.

In 1910, Verity described and figured a new form, which he called *orientis*, from the eastern part of southern Siberia.

In 1916, Francis Kermode recorded *Papilio machaon* var. *aliaska* from Atlin, in the extreme northwest of the Province of British Columbia, northeast of Skagway, Alaska, and just south of the Yukon border, where it had been collected by E. M. Anderson, and figured a typical specimen from that locality.

In 1916, William Barnes and J. McDunnough published a photograph of a male specimen of *Papilio aliaska* from Rampart House, Alaska, resembling the specimen shown on Plate 2, and said that there is no doubt that the form to which Scudder applied the name *aliaska* is the form that Verity redescribed under the name of *joannisi*. They added that the few specimens from Alaska that they personally had seen had all been of the form *aliaska*. They said further

that whether the specimen figured by Holland really came from Alaska or not is an interesting point for collectors to clear up; if it be correct, then there would be two distinct forms of *machaon* in our northern fauna differing in the relative width of the black submarginal band on the secondaries.

In the second edition of "The Butterfly Book," published in 1931, Doctor Holland republished the figure given in 1898, designating it as "type" of *Papilio aliaska*. In the text he said that it is one of the "types" determined by Scudder, and that it was taken at Rupert House on Hudson Bay. It is, therefore, the specimen that Scudder said had been sent him by Edwards. It can not be regarded as the type specimen of *aliaska*, since in the first place the original description fits only the specimens from Nulato and the Ramparts, and in the second place it was only incidentally mentioned by Scudder.

Doctor Holland said that he has another "type" from Scudder's original material labeled as from "Alaska," which exactly agrees with Verity's figure of his *joannisi*. He remarked that the Carnegie Museum has a specimen taken on the peninsula of Labrador, on the eastern shore of Hudson Bay, which is the same. He added that the Carnegie Museum has a long series of specimens from "all parts of Alaska," which are "unmistakably the same thing." These specimens, he said, had been carefully compared with specimens from northeastern Siberia labeled *orientis* by Verity, and they were indistinguishable from the latter. He remarked that in the long suite of specimens that he had critically examined the only difference is an almost inappreciable variation in the width of the black outer margin of the fore wings, which is only individual, and reveals itself both in American and in Asiatic specimens. He said that the insect, as the figure shows, resembles *P. m. machaon* of Europe, but the yellow areas of the wings are not so wide as in the latter.

For some time Foster H. Benjamin had been aware of the very considerable differences between Alaskan and Hudsonian specimens of *Papilio machaon*, and he recently was so kind as to suggest that I look into the matter on the basis of the material in the National Museum, including the Barnes collection.

From the available material *Papilio machaon* appears to be represented in North America by three different forms: One in the region between southwestern Hudson and James Bays and Lake Superior; a second—Scudder's *aliaska*—in Alaska and the adjacent portions of Yukon and Mackenzie; and a third, closely resembling the first, also occurring in Alaska.

The eastern form and the very similar form from Alaska are described below.

PAPILIO MACHAON HUDSONIANUS, new subspecies

PLATE 3, FIGURES 1, 2

- Papilio zolicaon* WEIDEMEYER, Proc. Ent. Soc. Philadelphia, vol. 2, p. 148, 1863 (in part; Labrador).
- Papilio machaon* W. H. EDWARDS, Can. Ent., vol. 1, p. 22, 1863 (Rupert House).
- Papilio aliaska* (in part) SCUDDER, Proc. Boston Soc. Nat. Hist., vol. 12, p. 407, 1869 (east coast of Hudson Bay [refers to Rupert House]; the specimens from Nulato and the Ramparts, on which the description is based, represent *P. m. aliaska*).—HOLLAND, Butterfly book, 2d ed., p. 314, 1931 ("type" from Rupert House and specimen from Labrador).
- Papilio machaon* var. *aliaska* W. H. EDWARDS, Papilio, vol. 2, no. 5, pp. 74-75, May, 1882 (Rupert House; particulars of capture; 8 Alaskan specimens are *P. m. aliaska*; comparison with Asiatic forms); vol. 3, no. 3, p. 60, Mar., 1883 (= Himalayan form).—HOLLAND, Butterfly book, pl. 41, fig. 1, 1898 (but not *Papilio aliaska*, p. 312, no. 9 = *P. m. aliaska*).—HOLLAND, Butterfly book, 2d ed., pl. 41, fig. 1, 1931.
- Papilio machaon* a. *aliaska* WILSON, 34th Ann. Rep. Ent. Soc. Ontario, 1903, p. 90, 1904 (Hudson Bay slope; Forget Portage, Nagagami River, 63 miles northward of Montizambert Station, Canadian Pacific Railway, and 22 miles north of height of land, measured along the canoe routes, lat. 49° 12' 47" N.).
- Papilio machaon aliaska* VERITY, Rhopalocera Palaearctica, p. 15, 1905 (includes *P. m. kamtschadalus*; found in Alaska and Kamchatka; his idea of the subspecies based on Holland's figure).—ROTHSCHILD and JORDAN, Nov. Zool., vol. 13, no. 3, p. 553, no. 65a, Aug. 30, 1906 (in part; Hudson Bay, but not other localities).—JORDAN, in Seitz, Macrolepidoptera of the world, vol. 5, p. 24 (in part; Hudson Bay); pl. 8, line b, *aliaska*, male, 1907 (apparently copied from Holland).
- Papilio aliaska* BARNES and McDUNNOUGH, Contributions to the natural history of the Lepidoptera of North America, vol. 3, no. 2, p. 54, Dec. 5, 1916 (questions the identity of Holland's figure).

Description.—Larger than *P. m. aliaska* Scudder (the fore wing 40 mm long), with the outer border of the fore wings slightly, though distinctly, convex instead of straight, and the tails on the hind wings shorter, although the hind wings do not differ in shape.

On the *upper side* the black base of the fore wings is much less heavily speckled with olive scales than is the case in *P. m. aliaska*; the black outer border is more nearly of uniform width, not becoming so much broadened posteriorly; the black band across the middle of the outer half of the cell has converging instead of parallel sides, so that the costal end is much broader than the end lying on the lower border of the cell; the veins are rather less heavily black; and the black spot in the yellow triangle between veins SC₄ and SC₅ is smaller and is completely isolated from the black above and below it.

On the hind wings the inner edge of the dark border is more regularly and strongly curved, so that the end of the cell is distant from the dark border about the width of the cell instead of almost touching it as in the case of *P. m. aliaska*; and the black line on the

lower border of the orange anal spot is thicker, encroaching more on the spot itself.

On the *under side* the submarginal yellow spots of the fore wings are rather small, well rounded, and entirely separated from each other by black veins, the row of spots occupying less than half the width of the black border itself, whereas in *P. m. aliaska* this row of spots is represented by a broad yellow band, quite continuous or with indicated interruptions at the veins, which occupies more than half the width of the black border.

On the hind wings the inner margin of the dark border is more regularly curved, the black lines forming this margin being only slightly discontinuous between veins R_2 and R_3 and R_3 and M_1 , whereas in *P. m. aliaska* the black lines in these interspaces are very widely separated from the corresponding lines above; the dark border is less heavily washed with blue and olive scales; the submarginal lunules are smaller; the black border of the orange anal ocellus is very narrow laterally, sometimes even almost completely interrupted, but posteriorly is broadened into a conspicuous black oval spot deeply excavating the posterior portion of the ocellus; and there is no orange scaling between the cell and the dark border between veins R_2 and R_3 , and R_3 and M_1 , or above the orange anal spot. The black border of the anal ocellus above is narrow, as in *P. m. machaon*, and beneath it is a narrow crescent of blue scales.

The dark markings above are dark brown, not intense black as in *P. m. aliaska*, giving the insect a rather washed-out appearance.

Type specimen.—U.S.N.M. No. 34478, female, from Kettle Rapids, Nelson River, Manitoba, on the Hudson Bay Railway, July 8, 1914 (William Barnes collection).

Other specimens examined.—One female from the type locality, and one male from Hymers, Ontario (on the northwestern shore of Lake Superior southwest of Fort William and near the Minnesota boundary), July 8, 1915 (Barnes collection).

Other records.—Rupert House, on the southeastern shore of James Bay (Edwards, 1868, 1882, 1883; Scudder, 1869; Holland, 1931); Labrador (Weidemeyer, 1863; possibly based on the specimens from Rupert House); peninsula of Labrador, on the eastern shore of Hudson Bay (Holland, 1931; possibly one of the specimens recorded by Edwards from Rupert House); Nagagami River, north of Lake Superior (Wilson, 1904).

Range.—From Kettle Rapids, near Port Nelson, at the mouth of the Nelson River on the western shore of Hudson Bay, to Rupert House at the southeastern extremity of James Bay, and Hymers, Ontario, on the western shore of Lake Superior a few miles north of the Minnesota boundary. This form inhabits low and largely forested country.

Season.—July and August.

Comparisons.—*Papilio machaon hudsonianus* is very closely related to typical *P. m. machaon* of western Europe, from which it differs in the slight, but characteristic, convexity of the outer margin of the fore wings, in the shorter tails, in the generally duller color, in the excavation of the orange anal ocellus by the thickening of its black posterior border, and in the small size and isolation of the black spot on the fore wing in the yellow triangle between veins SC_4 and SC_5 .

Among its American relatives it is perhaps most easily confused with *Papilio bairdi* form *oregonia*. But the convexity of the outer border of the fore wings, the short tails, the deeper color, the small size of the black spot connected with the orange anal ocellus, which lies on its lower border instead of being more or less completely within it, the narrower dark border of the hind wings, and the usually greater extent of the broad dark abdominal border of the hind wings serve to distinguish it.

PAPILIO MACHAON PETERSII, new subspecies

PLATE 4; PLATE 5, FIGURE 3; PLATE 6, FIGURE 3

Description.—Closely related to *P. m. hudsonianus*, with the same wing shape and the same short tails, but somewhat smaller (the fore wing 37 mm long) and darker yellow.

On the *upper side* the fore wings have the dark border very slightly narrower, and there are almost no olive scales in the black basal portion.

On the hind wings the orange anal ocellus is circular and is bordered, except for a short sector one end of which adjoins the outer half of the lower end of the dark margin, by a narrow black ring, which is about twice as broad above the ocellus as elsewhere.

On the *under side* the yellow is deeper than in *P. m. hudsonianus*, especially on the hind wings. On the fore wings the submarginal spots are united into a broad band with straight borders crossed by hairlike black veins, and the dark border is narrower than on the upper surface. The yellowish scaling on the black basal portion of the wing is confined to the cell, where it is less extensive than it is in *P. m. hudsonianus*.

On the hind wings the submarginal lunules are larger and the dark border is slightly narrower, the inner ends of the lunules lying about midway between the edge of the wing and the inner edge of the dark border instead of nearer the former as in *P. m. hudsonianus*.

Type specimen.—U.S.N.M. No. 34479, male (pl. 4), from the Koyukuk River, central Alaska (lat. 67° – 69° N., long. 151° W.), captured in the summer of 1901 by Capt. W. J. Peters, now of

the Department of Terrestrial Magnetism, Carnegie Institution of Washington.

The preceding information was taken from the label accompanying the specimen. Captain Peters writes me that the collection of insects that included this specimen, and also several examples of *P. m. alaska*, was made by Tom Hunt, one of his field men, between the middle of June and August 10, 1901, along the western slope of the valley of the Totsenbetna River, and from the headwaters of the Anaktuvuk River down this river to the Arctic Ocean.

Additional specimen.—A male from the Ramparts, on the middle Yukon, taken at an altitude of 1,000 to 3,000 feet in June, 1922, of which Dr. Karl Jordan was so very kind as to send me photographs of both surfaces (pl. 5, fig. 3; pl. 6, fig. 3; see page 13) is very close to the type, which was captured about 75 miles to the north.

The light dusting on the dark base of the fore wings above, and on the dark outer border just within the row of yellow spots, is as heavy as in most specimens of *P. m. alaska*—heavier than in some. On the hind wings the blue spots on the dark margin between the lunules and the inner border are prominent, though rather small as in the type. On the under side the light scaling on the black band following the submarginal yellow band on the fore wings is well developed, forming a narrow median line, and the light dusting between the submarginal lunules and the inner edge of the dark border on the hind wings is heavy. These features are probably due to the fact that this is a fresh specimen, while the type is rather worn.

The wing shape of this specimen is identical with that of the type, as is shown by superposition of photographs before a strong light. On the upper surface the band across the outer half of the cell of the fore wing is narrower than in the type, and the inner margin of the dark outer border of the hind wing is somewhat more evenly curved. On the under side of the fore wing the band across the middle of the cell and that across the end of the cell are slightly narrower than in the type.

Note.—*Papilio machaon petersii* bears much the same relation to *P. m. hudsonianus* that *Papilio glaucus arcticus* bears to *P. g. glaucus* and *P. marcellus marcellus* bears to *P. m. lecontei*. It appears to be a dwarf form living under rigorous conditions.

The present subspecies differs from *P. machaon hudsonianus* in the direction of *P. m. kamtschadabus*, which is a small deeply colored form with the outer border of the wings convex, short tails, a submarginal band on the under side of the fore wings, and enlarged submarginal lunules on the hind wings. Indeed, both *P. m. petersii* and *P. m. hudsonianus* might be considered, especially on the basis of the wing shape and the color, to be more closely related to *P. m. kamtschadabus* than to any other subspecies of *P. machaon*. Verity

was to a large extent justified in regarding *kamtschadalus* as a synonym of *aliaska*, interpreted on the basis of Doctor Holland's figure. In *P. m. kamtschadalus*, however, the black markings are more restricted than they are in the corresponding American forms, the dark border on the hind wings in particular being very narrow, that portion within the row of submarginal lunules being not so broad as the lunules themselves.

PAPILIO MACHAON ALIASKA Scudder

PLATE 2, FIGURES 1, 2; PLATE 5, FIGURES 1, 2, 4-6; PLATE 6, FIGURES 1, 2, 4-6;
PLATES 7, 8

- Papilio aliaska* SCUDDER, Proc. Boston Soc. Nat. Hist., vol. 12, p. 407, 1869 (description; Alaska, Nulato and a short distance below the Ramparts, and also just above them; specimen from Hudson Bay is *hudsonianus*).—HOLLAND, Butterfly book, p. 312, 1898 (Alaska; not pl. 41, fig. 1, which is *hudsonianus*).—BARNES and McDUNNOUGH, Contributions to the natural history of the Lepidoptera of North America, vol. 3, no. 2, p. 54, pl. 4, fig. 2, Dec. 5, 1916 (Rampart House; *joannisi* Verity a synonym of *aliaska*).—HOLLAND, Butterfly book, 2d ed., p. 314, 1931 (Alaska; includes *joannisi* Verity; specimens from Rupert House and Labrador are *hudsonianus*).
- Papilio machaon* var. *aliaska* W. H. EDWARDS, Papilio, vol. 2, no. 5, pp. 74-75, May, 1882 (St. Michael; comparison with Old World forms; specimens from Rupert House are *hudsonianus*); vol. 3, no. 3, p. 60, Mar., 1883 (same as the Himalayan form).—LYMAN, Can. Ent., vol. 32, no. 4, p. 119, Apr., 1900 (Dawson, Yukon).
- Papilio machaon* a. *aliaska* KEELE, 35th Ann. Rep. Ent. Soc. Ontario, 1904, p. 61, 1905 (quite common along the shores of Mayo Lake and valley of Mayo River, Yukon, during July and August).
- Papilio zolicaon* WRIGHT, Butterflies of the West Coast, p. 86, 1906 (in part; Port Wrangel, Alaska).
- Papilio zolicaon* ROTHSCHILD and JORDAN, Nov. Zool., vol. 13, no. 3, p. 550, Aug. 30, 1906 (Alaska; based on Wright's record).
- Papilio machaon aliaska* ROTHSCHILD and JORDAN, Nov. Zool., vol. 13, no. 3, p. 553, no. 65a, Aug. 30, 1906 (synonymy; Alaska, but not Oregon or Hudson Bay).—JORDAN, in Seitz, Macrolepidoptera of the world, vol. 5, p. 24, 1907 (Alaska; Hudson Bay refers to *hudsonianus*, which is the form figured; includes *joannisi* Verity).—KERMODE, Rep. Provincial Mus. Nat. Hist. (British Columbia) for the year 1915, p. N 16, pl. 8, fig. 1, 1916 (Atlin, British Columbia).
- Papilio machaon joannisi* VERITY, Rhopalocera Palaearctica, p. 12, pl. 10, fig. 16, 1907 (Alaska).—JORDAN, in Seitz, Macrolepidoptera of the world, vol. 5, p. 24, 1907 (synonym of *aliaska*).—BARNES and McDUNNOUGH, Contributions to the natural history of the Lepidoptera of North America, vol. 3, no. 2, p. 54, Dec. 5, 1916 (synonym of *aliaska*).—HOLLAND, Butterfly book, 2d ed., p. 314, 1931 (synonym of *aliaska*).

Note on the type specimen.—Prof. Nathan Banks, of Harvard University, has been so kind as to write me that there is in the collection of the Museum of Comparative Zoology at Harvard College a speci-

men bearing the label "*aliaska*, male, type, S. H. S." in Scudder's handwriting. It also carries a museum type label placed with it by Samuel Henshaw.

Professor Banks was good enough to compare this type specimen with prints of the photographs shown as Figure 1 on Plate 2, and Figure 1 on Plate 3. He writes that the type specimen agrees with the specimen shown as Figure 1 on Plate 2 in having the first broad pale band crossing the cell of the primaries with parallel sides and not widened posteriorly, as well as in the other points about which I inquired. On the back of the photograph reproduced as Figure 1 on Plate 2 he wrote "type like this."

The specimen shown on Plate 2 may therefore be regarded as typical of *P. m. aliaska*.

Specimens examined.—Seventeen, with the following data: Nushagak, Alaska (eastern end of Bristol Bay, at the base of the Alaska Peninsula), July 5, 1881; St. Michael, Alaska (on the southern shore of Norton Sound); Big Hurrah Creek, 40 miles northeast of Nome, on the northern shore of Norton Sound; Rampart (on the Yukon in central Alaska), June 22; Koyukuk River, central Alaska (lat. 67°–69° N., long. 151° W.), summer of 1901, Capt. W. J. Peters; Alaska, vicinity of the Porcupine River on the Alaska-Yukon boundary (lat. 67° 25' and 66° 31' N., long. 141° W.), June 12, 1912; Yukon, Canada, July 18, 1916; Nahanni Mountains, Mackenzie, at an altitude of 2,500 feet, July 16, 1903.

In addition to these specimens I have been able, thanks to the generosity of Dr. Karl Jordan, to study most excellent full-size photographs of both surfaces of 12 specimens from the Ramparts on the middle Yukon taken at an altitude of 1,000 to 3,000 feet in June, 1922, which are in the collection of the Zoological Museum at Tring, Hertfordshire, England (pls. 5–8).

Range.—From Bristol Bay (Nushagak River) north to Cape Prince of Wales (Big Hurrah Creek) and eastward, extending north of the Arctic Circle on the Koyukuk River in central Alaska and on the Canadian border, as far as Mayo Lake, Yukon, the Nahanni Mountains, Mackenzie, on the Yukon-Mackenzie boundary just north of British Columbia (lat. 60° 48' N., long. 122° 40' W.), at an altitude of 2,500 feet, and Atlin, in the extreme northwest of British Columbia. This form inhabits mountainous or rugged country, where it is found near woods or patches of trees or in sparsely wooded areas.

Season.—From the third week in May to August; most of the records are in June and early July.

Variation.—*Papilio machaon aliaska* is a very variable form, at least in certain localities. Although the specimens figured by Verity,

Barnes and McDunnough, and Kermode are strikingly similar and most of those that I have seen resemble them closely, the series from the Koyukuk River and those in Lord Rothschild's collection from the Ramparts about 75 miles to the southward (pls. 5-8) are so very variable that scarcely any two are alike.

The *fore wing* varies greatly in shape. The outer border may be nearly at right angles to the lower border, as in the specimen figured (pl. 7, fig. 3), or it may make as large an angle with the lower border (pl. 7, fig. 6) as in the Chinese specimen figured (pl. 1) or in *P. m. hudsonianus* (pl. 3). The outer border may be straight (pl. 7, fig. 6), as in the specimen figured (pl. 2), or slightly, or even rather strongly (pl. 7, fig. 5) convex, the submarginal spots in the last case lying in a broad curve; it may be evenly curved (pl. 7, fig. 1), or straight in the anterior half and curving broadly inward in the posterior half (pl. 7, fig. 3) so that the lower angle of the wing is very broadly rounded. The apex is commonly more broadly rounded than in the specimen figured (pl. 2), though it may be more acute (pl. 5, fig. 5).

The dusting of light scales over the dark base of the fore wing is usually about the same as in the specimen figured, but is often less heavy, and the black outer margin of the dark base is usually broader within the cell, and often also beneath the cell (pl. 5, fig. 4). The submarginal yellow spots vary greatly in size, in some being larger (pl. 7, fig. 5) and in others smaller (pl. 5, fig. 3) than in the specimen figured. The black border is usually broader posteriorly than anteriorly, but in one specimen (pl. 7, fig. 5) its inner edge is parallel with the outer edge of the wing. It is usually about as in the specimen figured (pl. 2), but it may be broader (pl. 5, fig. 2; pl. 7, fig. 2), though not so broad as in the Chinese specimen shown (pl. 1.). The band across the middle of the outer half of the cell is often less regular (pl. 7, figs. 1, 4, 5) than in the specimens figured (pl. 2). It may be wedge-shaped with the lower end less than half as broad as the costal end or even narrower (pl. 7, fig. 1); the distal (adapical) border is commonly rather broadly excavated at about the middle (pl. 5, fig. 1), while there may be a smaller and more angular indentation on the proximal border near the lower end (pl. 7, figs. 3, 4). If both of these indentations are developed (pl. 7, fig. 5) the lower half of the band becomes chevron-shaped with the angle directed apically and the lower end very narrow.

On the under side the fore wing is in all cases essentially as in the specimen figured (pl. 2, fig. 2); the marginal light band is sometimes narrower (pl. 6, fig. 3), or even slightly broader (pl. 8, fig. 5), and the dark band just within it varies considerably in relative width (compare figs. 2 and 6, pl. 8).

The *hind wing* is always narrow, though sometimes a little broader than in the specimen figured. The indentations along the outer border are usually less deep than in the specimen figured, and are often slight (pl. 7, fig. 6). The tails vary greatly in length. They are seldom so long as in the specimen figured (pl. 2), in which the distance from the tip of the tail to the deepest portion of the scallop just above its base is nearly one-third greater than the distance between the tips of the veins on either side of the tail. In a few specimens the distance from the tip of the tail to the deepest part of the scallop just above the base is considerably less than the distance between the tips of the veins on either side of the tail (pl. 7, fig. 2), and rarely the base of the tail is broadened (pl. 7, fig. 1) so that it resembles the tail of *P. m. hudsonianus* as figured by Holland.

The dark outer border of the wing sometimes touches the end of the cell at the lower radial vein (pl. 5, fig. 6), and the section of the lower radial between the end of the cell and the dark border is in all the specimens except one from the Ramparts (pl. 5, fig. 3; referable to *petersii*; see beyond) markedly shorter than the dark bar at the end of the cell between the lower and upper radials; in this specimen it is only very slightly shorter. The inner edge of the dark border may be broadly and fairly evenly curved, as in the specimen from the Ramparts just mentioned, or it may be only slightly curved (pl. 5, fig. 1), or it may be broadly bowed in the middle (pl. 7, fig. 6), or just below the middle (pl. 7, fig. 4), becoming straighter at the two ends. In some specimens the inner edge of the border is much more convex in the interspaces than it is in others. The blue spots are usually somewhat larger than in the specimen figured, and may be considerably larger, almost touching the lunules (pl. 5, fig. 1); they are usually well defined and rather dense, but occasionally are poorly defined and obscure (pl. 7, fig. 1). The submarginal lunules vary considerably in size; they are usually larger than in the specimen figured (pl. 2), sometimes much larger (pl. 7, fig. 5) with broadly truncated ends. The dark abdominal border is very extensive; the yellow triangle at its lower end with its base resting on the black border of the ocellus is usually about as long as the diameter of the ocellus, though it may be shorter (pl. 5, fig. 2), and is often somewhat longer, rarely twice as long (pl. 7, fig. 4), so that its apex is not far below the origin of vein M_1 . The anal ocellus is always light in color, with a blue metallic crescent, usually rather narrow though sometimes broad as in the specimen figured, separating it from the uniform and rather narrow black band just above. In some specimens the crescent is indefinitely edged beneath in its outer half with dark scales (pl. 5, fig. 6), and rarely this indefinite edging is more or less complete, suggesting a

distant approach to the condition found in Asiatic specimens (pl. 1, fig. 1). In one specimen (pl. 5, fig. 1), the lateroposterior narrow black edging of the orange spot is abruptly expanded at the end, the swollen end lying almost entirely within the lower portion of the ocellus as in *P. m. hudsonianus* (pl. 3).

On the under side of the hind wings the marginal lunules are very variable in size, and in most of the specimens are larger than in the one figured (pl. 2, fig. 2). In the specimen (pl. 5, fig. 3; pl. 6, fig. 3) with the dark border narrowest on the upper surface (referred above to *petersii*) the inner margin of the dark border below is similar to that in the type specimens of *petersii* and of *hudsonianus*. In the other specimens it varies from the condition seen in the type specimen of *petersii* to the condition seen in the specimen of *aliaska* figured (pl. 2, fig. 2), being in most cases about halfway between the two.

Comparisons.—As is evident from the figures, *P. m. aliaska* resembles *P. m. sikkimensis* more closely than it does *P. m. hudsonianus*. As was pointed out by Edwards in 1882, both *aliaska* and *sikkimensis* are strongly melanic. Both have the dark border of the hind wings above broad, nearly reaching the cell, but narrow below, where the inner border is formed of widely discontinuous black lines, and both have a broad submarginal band instead of a row of isolated spots on the under side of the fore wings. Specimens from the mountains of western China (pl. 1, figs. 1, 2) are more or less intermediate between the two, and Doctor Holland is probably correct in reporting *aliaska* from northeastern Asia.

As it occurs in Tibet and western China, *sikkimensis* is always readily distinguishable from *aliaska* by having the orange anal ocellus edged above with a broad black border including a thin blue crescent. In *aliaska* the blue crescent usually lies partly on the lower half of the rather broad black border and partly on the upper portion of the ocellus itself; but it may lie entirely on the black border, or it may have a poorly defined proximal border, scattered blue scales occurring over the upper half of the ocellus.

SUMMARY

In northern North America *Papilio machaon* is represented in the region between Hudson and James Bays and Lake Superior by a relatively large short-tailed form, *P. m. hudsonianus*, much like typical *P. m. machaon* from northern Europe, which appears to show but little variation.

In Alaska, Yukon, southwestern Mackenzie, and northwestern British Columbia there is a second form, *P. m. aliaska*, most closely related to a group of Asiatic forms of which *P. m. sikkimensis* may be taken as an example. Judged from the meager information avail-

able, this form appears to be well defined and stable throughout the greater part of its range; but in central Alaska it becomes very variable, and with it is found a third form, *P. m. petersii*, which approaches the Kamchatkan *P. m. kamtschadalus*, being intermediate between *P. m. hudsonianus* and *P. m. kamtschadalus*. Although *P. m. petersii* is very different from typical *P. m. aliaska*, the two seem to intergrade in the region in which both occur.

KEY TO THE AMERICAN SUBSPECIES OF PAPILIO MACHAON

- a*¹. Dark border of hind wings broad, the distance from the inner margin of the border to the black bar at the end of the cell less than the length of the bar; dark border of hind wings beneath narrower than above, the black lines in the interspaces delimiting the dark border interiorly widely discontinuous except for the two uppermost; tails of hind wings moderate in length or rather long, the distance from the tip of the tail to the deepest portion of the scallop just above its base being greater than the distance between the tips of the veins on either side of the tail; outer border of fore wings approximately straight; dark markings above black; Plate 2 (Alaska and adjacent portions of Yukon and Mackenzie)----- *aliaska*.
- a*². Dark border of hind wings narrower, the distance from the inner margin of the border to the black bar at the end of the cell greater than the length of the bar; dark border of hind wings beneath not narrower than above, the black lines in the interspaces delimiting the dark border interiorly almost continuous; tails of hind wings short, their length from the tip to the deepest portion of the scallop just above their base being considerably less than the distance between the tips of the veins on either side of the tail; outer border of fore wings distinctly convex; dark markings above brown.
- b*¹. Larger, the fore wing about 40 mm long; submarginal spots on lower surface of fore wing rounded and entirely distinct from each other; submarginal lunules on under side of hind wings of moderate size, the inner edge of the second and third from the costal border lying much less than halfway from the outer edge of the interspace to the inner margin of the dark border; posterior portion of the black margin of the orange anal ocellus expanded into a broad oval patch deeply encroaching on the ocellus; Plate 3 (Hudson Bay to Lake Superior)----- *hudsonianus*.
- b*². Smaller, the fore wing about 37 mm long; fore wings below with a broad light submarginal band crossed by dark hair lines at the veins; submarginal lunules on lower side of hind wings large, the inner edge of the second and third from the costal border lying halfway between the outer edge of the interspace and the inner margin of the dark border; lateral and posterior narrow black edging of the orange anal ocellus of uniform width, the ocellus being circular; Plate 4 (central Alaska)----- *petersii*.